Appendix 1

Symbols and concepts used in this paper

Symbol or concept	Description	Unit
Chemical substances		
N	nitrogen, also nutrient in general	n.a.[1]
P, K	phosphorus, potassium	n.a.
DM, H_2O	dry matter, water	n.a.
Subscripts		
N, P, K, H2O	nitrogen, phosphorus, potassium, water	n.a.
ext	external	n.a.
sol	soil solution	n.a.
min, max	minimum, maximum of a quantity	n.a.
Model parameters		
ε_N	diffusion exchange rate of N	d^{-1}
λ_N, λ_P, λ_K	relative loss rate of nutrients (N, P, K)	d^{-1}
λ_{H2O}	relative loss rate of water	d^{-1}
φ, φ_N, φ_P	abruptness of the bending (nutrient, N, P)	dimensionless
α_N, α_P, α_K	affinity coefficient of nutrients (N, P, K)	g(DM) g(nutrient)$^{-1}$ d^{-1}
α_{H2O}	affinity coefficient of water	g(DM) g(water)$^{-1}$ d^{-1}
α_{NP}	nutrient interaction affinity for N × P	g(DM) m^{-2} d^{-1} g(N)$^{-1}$ g(P)$^{-1}$
α_{PK}	nutrient interaction affinity for P × K	g(DM) m^{-2} d^{-1} g(P)$^{-1}$ g(K)$^{-1}$
α_{NK}	nutrient interaction affinity for N × K	g(DM) m^{-2} d^{-1} g(N)$^{-1}$ g(K)$^{-1}$
α_{NPK}	nutrient interaction affinity for N × P × K	g(DM) m^{-2} d^{-1} g(N)$^{-1}$ g(P)$^{-1}$ g(K)$^{-1}$
$\alpha_{N\text{-}H2O}$	nutrient interaction affinity for N × H_2O	g(DM) m^{-2} d^{-1} g(N)$^{-1}$ g(H_2O)$^{-1}$
r_{max}	maximum production rate	g(DM) m^{-2} d^{-1}
n_{min}, n_{max}	N content (minimum, maximum)	g(N) g(DM)$^{-1}$
p_{min}, p_{max}	P content (minimum, maximum)	g(P) g(DM)$^{-1}$
k_{min}, k_{max}	K content (minimum, maximum)	g(K) g(DM)$^{-1}$
$h2o_{min}$, $h2o_{max}$	H_2O content (minimum, maximum)	g(H_2O) g(DM)$^{-1}$
Input variables		
S_N, S_P	nutrient supply rates (N, P)	g(nutrient) m^{-2} d^{-1}
S_{H2O}	water supply rate	g(water) m^{-2} d^{-1}
$S_{N\text{-}ext}$, $S_{P\text{-}ext}$, $S_{K\text{-}ext}$	external nutrient supply rates (N, P, K)	g(nutrient) m^{-2} d^{-1}
$S_{H2O\text{-}ext}$	external water supply rate	g(water) m^{-2} d^{-1}
System variables		
N_{sol}, P_{sol}	soil nutrient concentrations (N, P)	g(nutrient) m^{-2}
N_{ext}	'external' soil-N concentration	g(N) m^{-2}

Symbol or concept	Description	Unit
r	production rate (dry matter)	g(DM) m^{-2} d^{-1}
r_N, r_P	nutrient uptake rates (N, P)	g(nutrient) m^{-2} d^{-}
n, p	plant nutrient contents (N, P)	g(nutrient) g(DM)
$h2o$	plant water content	g(water) $g(DM)^{-1}$
Other symbols and concepts		
V_{max}; V	(maximum) reaction rate	g m^{-3} d^{-1}
C	concentration of limiting compound	g m^{-3}
K	Michaelis–Menten constant	g m^{-3}
x	nutrient supply rate (normalized)	dimensionless
y	production rate (normalized)	dimensionless
t	time	d (= day)
dN_{sol} / dt	differentiation of N_{sol} with respect to time	g(N) m^{-2} d^{-1}
dr / dN_{sol}	differentiation of r with respect to N_{sol}	g(DM) $g(N)^{-1}$ d^{-1}
min(...); max(...)	minimum function; maximum function	n.a.
exp(...)	exponential function	n.a
stock or level	quantity of a substance at a certain time	g
rate	change per unit of time of a level	g d^{-1}
ratio	quotient between quantities of the same units	dimensionless
content	a mass fraction of total mass	g g^{-1}
concentration	mass per unit of area or per unit of volume	g m^{-3}
parameter	a constant quantity in a model	n.a.
coefficient	see parameter	n.a.

[1] n.a. = not applicable.